Where is the Border Between an Information System and a Knowledge Management System?

Imandra Galandere-Zile
The Treasury of the Republic of Latvia
Viktorija Vinogradova
Riga Technical University
Latvia

Both information systems and knowledge management systems are important in an organization and often fulfil the same or equal task. The aim of this paper is to identify the border between these two systems. The approach of the research is to analyse both systems in order to identify their role in an organization, determine their problems, advantages, and opportunities, discover common issues and differences between them and find out when an information system becomes a knowledge management system and when it is useful to implement the latter.

1 INTRODUCTION

Nowadays information systems play a very important role in improving an organisation's performance and its increased competitive capacity. Therefore, it is essential for organisations to decide what are the most important business processes and core competencies that have to be supported by an information system and what kind of information system has to be implemented and conforms to the organisation's requirements.

While recent trends in organisational development have demonstrated the importance of knowledge management, there is no universal definition of knowledge management or a knowledge management system. Knowledge management systems are mostly built over existing information systems, thus it is difficult to determine when an information system becomes a knowledge management system or what kind of features are encompassed in the former and not in the latter.

The goal of the paper is to identify the border between information systems and knowledge management systems, and discover common and uncommon features between them in order to find out when an information system becomes a knowledge management system and when it is useful to implement the latter.

The paper is organised as follows. In Section 2 the data, information and knowledge are analysed since they play an essential role in informa-

tion systems and knowledge management systems. Considerations regarding information systems and their role in an organisation are discussed in Section 3. In Section 4 the area of knowledge management and its role in an organisation is discussed and the knowledge cycle and knowledge management framework are provided. Section 5 focuses on the relationship between knowledge management and information systems, and the contribution of information technology and systems to knowledge management is also discussed. In Section 6, similarities and differences between both systems are identified and analysed. Brief conclusions and directions of future work are provided in Section 7.

2 DATA, INFORMATION AND KNOWLEDGE

Since data, information and knowledge play an essential role in both the information and the knowledge management system they were analysed first. In practice, the terms data, information and knowledge are often used interchangeably. First, differentiation is generally difficult because data is located in terms of the information manufacturing system. Second, users interpret data when they use them. Users' contexts and the information manufacturing process make it difficult for users to determine precisely whether a piece is data, information, or even knowledge. Although it might take a decade just to determine what these three words mean, we all agree that the transformation of data is important in order to provide users with a clearer and more meaningful information. Structuring and managing knowledge assets in an organisation are also critical for all organisations. The data represents facts that are created when business processes are performed. It is a set of particular and objective facts about an event or simply the structured record of a transaction (Tiwana 2000). Data is the lowest level of known facts. Data can be stored in a structured relational database system or an unstructured document management system, and includes non-text information, such as voice and image. Data is collected, stored, grouped, analysed, and interpreted (Huang et al. 1999).

The terms data and information are often used synonymously (like information and knowledge). In practice, managers differentiate between information and data intuitively and describe information as a data that has been processed. Information contains a substance and a purpose. There are different ways in which meaning can be added to data in order to transform it into information. Data becomes information through condensation, contextualisation, calculation, categorisation and/or cor-

rection processes (Tiwana 2000). What qualifies as useful information in different situations is a subjective judgment. Information moves around in both electronic and hard format, through electronic networks and social networks.

The key link between knowledge and information is probably best expressed in the commonly accepted idea that knowledge, in the business context, is nothing but actionable information. Knowledge is generated when information is combined with context and experience. Knowledge is a fluid mix of framed experience, values, contextual information, expert insight and grounded intuition that provides an environment and framework for evaluating and incorporating new experience and information. It originates and is applied in the minds of those in possession of the relevant knowledge. In organisations it often becomes embedded not only in documents or repositories but also in organisational routines, processes, practices and norms (Tiwana 2000). We strongly agree with Tiwana (2000) who says that data and information are essential, but it is the knowledge that can be applied, experience that comes into context, and skills that are used at that moment that make the difference between a good and a bad decision.

3 Considerations Regarding the Information System and Its Role in an Organisation

This section presents a short overview of information systems and the benefits that can be acquired by implementing and applying them.

Information systems are widely used in organisations. They provide information and thus help the operation and management of the organisation. An information system can be defined as a group of components working together. These components include equipment (or hardware), instructions (or software), data stored in the system, people to operate the system, and procedures for the people to follow (Nickerson 1998). Because information processing can be done using manual instructions, a wider view on information systems is also possible. Thus a computerised information system is just one of the information systems. In this paper we consider only computerised information systems.

The information system supports one or more work systems using information technology to capture, transmit, store, retrieve, manipulate or display information (Alter 1999). A work system is a system in which human participants perform business processes using information, technology, and other resources to produce products for internal or external

customers. The core of the work system (and thus information system) is a business process consisting of steps related in time and place, having a beginning and an end, inputs and outputs.

There are a wide variety of different information systems that can be classified by:

- Number of users – individual, workgroup, organisational and inter-organisational.
- Ways users are connected to information technology – directly, through network, through the Internet.
- Supported business functions – accounting, transaction, manufacturing etc.

Business processes are at the core of every information system. Information systems support business processes for one or more business functions. The simplest information systems support only one business function, e. g. inventory systems, payroll systems etc., in other cases information systems support a number of business functions. In these case the information between those functions is transmitted automatically saving time and work that would be necessary to maintain the integrity of these functions in the organisation. These information systems can thus be called *integrated.*

Information systems provide several benefits to the organisation (Nickerson 1998). One of the main benefits is *better information.* Information systems not only store and process data, but they also produce information, which is the basis for a good decision-making. Better information is available if data is properly managed in the information system, i. e. is available for processing, is current, accurate, and secure (Alter 1999). Another benefit is *improved service.* Information systems operate at any time of the day or night and process data faster than humans. A third benefit is *increased productivity.* With information systems, people can do more productive work in a shorter period of time.

4 KNOWLEDGE MANAGEMENT AND ITS ROLE IN AN ORGANISATION

In this section the area of knowledge management and its role in an organisation is discussed, and the knowledge cycle and knowledge management framework are provided.

While recent trends in organisational development have demonstrated the importance of knowledge management, there is no universal defini-

tion of knowledge management. Knowledge management addresses a broad scope of fields related to organisation, people, motivation, and technology. The goal of knowledge management is to increase the efficiency of activities related to knowledge as well as the benefits acquired from it. In order to transform knowledge into a valuable organisational asset, knowledge, experience, and expertise must be formalised, distributed, shared, and applied (Galandere-Zile 2002).

Knowledge management cycle reflects the life cycle of corporate knowledge. This dynamic process often starts with finding and collecting internal knowledge and best practices. The second step is sharing and understanding those practices so they can be used. Finally, the process includes adapting and applying such knowledge and practices to new situations and bringing them up to the best practice performance level. Knowledge management is concerned with supporting and optimising these processes. Surrounding the process, and helping or hiding it, are what we call the enablers. These are: leadership, culture, technology and measurement. These aspects of an organisation's environment and infrastructure must be addressed in order to transfer a business process and to develop knowledge management in an organisation (Zaharova and Galandere-Zile 2002).

Knowledge management has come to be regarded as the driving force behind some of the world's largest and most successful organisations. Knowledge management is seen as the next evolutionary step that goes beyond the 'Learning Organisation' or 'Business Process Re-engineering' and even beyond 'GroupWare' and the 'World Wide Web'. It is meant to integrate them all into a higher level, enterprise-wide framework with its new work roles, responsibilities, reward systems, methods and tools. In other words, true knowledge management concerns radical and fundamentally new ways of creating, retaining, sharing and leveraging knowledge about people and organisations that were simply not possible before.

5 THE STATE-OF-THE-ART CONCERNING KNOWLEDGE MANAGEMENT SYSTEMS AND INFORMATION SYSTEMS FOR KNOWLEDGE MANAGEMENT

This section focuses on the relationship between knowledge management and information systems and discusses the contribution of information technology and systems to knowledge management.

An Information System and a Knowledge Management System

Even though there is considerable disagreement in literature and business practice about what exactly knowledge management is, there are a number of researchers and practitioners who stress the importance and usefulness of information and communication technologies as enablers or vehicles for the implementation of these approaches. Knowledge management systems should particularly help to overcome the shortcomings of current practices of business engineering in regard to organisational performance (Maier 2002).

Technology by itself does not constitute a knowledge management programme, it rather facilitates one, especially in large, geographically dispersed organisations. Knowledge management represents an opportunity to derive additional benefits from an organisation's existing investment in computers, databases and networks by integrating them to support knowledge management in many ways (Zaharova and Galandere-Zile 2002). Technology's most valuable role in knowledge management is broadening the reach and enhancing the speed of knowledge transfer. The role of technology in knowledge management primarily lays in the two aspects that assist it the most – storage and communications (Tiwana 2000).

Past management information systems basically used the computer as a means of providing information to solve recurring operational problems. Today, there is a need for new types of systems that focus on discovering knowledge that responds to the changing environment. By increasing the capabilities of decision makers, information systems that support knowledge management initiatives improve the chances that an organisation will achieve its goals. Information systems that support information flow are an essential component of the knowledge management system. Information systems create a good virtual environment for knowledge management (Galandere-Zile 2004).

Examples for information and communication technologies that are related to knowledge management are the following (Maier 2002):

- *Intranet infrastructures* that provide basic functionality for communication – e-mail, teleconferencing – as well as storage, exchange, search and retrieval of data and documents.
- *Document and content management systems* handle electronic documents or Web content.
- *Workflow management systems* that support well-structured organisational processes and handle the execution of workflows.

- *Artificial intelligence technologies* that support, for example, search and retrieval, user profiling and matching of profiles, text and Web mining.
- *Business intelligence tools* that support the analytic process which transforms fragmented organisational and competitive data into goal-oriented 'knowledge' and require an integrated data basis that is usually provided by a data warehouse.
- *Visualisation tools* that help to organise relationships between knowledge, people and processes.
- *Groupware* that supports for example time management, discussions, meetings or creative workshops of work groups and teams.
- *E-learning systems* that offer specified learning content to employees in an interactive way and thus support the teaching and/or learning process.

Knowledge management systems significantly enhance functionality through an integrated combination of a substantial portion of the aforementioned information systems from the perspective of knowledge management. A knowledge management system should not be seen as a voluminous centralised database. It can rather be imagined as a large networked collection of contextualised data and documents linked to directories of people and skills, which provides intelligence to analyse these documents, links, employees' interests and behaviour, as well as advanced functions for knowledge sharing and collaboration (Maier 2002).

A knowledge management system has been a vision for the development of a new breed of information and communication technology systems. In this vision, the knowledge management system creates corporate information and communication technology environments, a contextualised base, and an infrastructure that takes into account the complex nature of knowledge and thus supports the handling of knowledge in organisations. In order to achieve this, a number of heterogeneous information and communication technologies have to be integrated, improved, recombined, and repacked. The development of a knowledge management system is a complex undertaking (Maier 2002).

Knowledge management has to handle and improve complex relationships and networks rather than individual knowledge elements or just one location, for e. g. a knowledge base. In the implementation process of a knowledge management system the content to be managed is very important. Companies that put organisational knowledge at the center of consideration implement knowledge management. Typically, the

organisation's knowledge structure is determined in workshops or reflects sources that already exist in the organisation, but are handled by a number of incompatible information and communication technology systems. In many cases, explicit knowledge is predominant. It is also a lot harder to describe implicit knowledge that is an equally important part of the organisational memory content (Maier 2002). Therefore, an important factor behind the implementation of knowledge management systems is the ability of the organisational personnel to share knowledge through some type of online forum.

Knowledge management systems organise and make available the important know-how wherever and whenever it is needed. This centres on 'best practices' or guiding principles, projected forecasts, reference sources, proven processes and procedures, patent information, established formulas, corrective fixes, and similar items. Data warehouses, computer networks, company intranets, extranets, groupware, bulletin boards, and video conferencing are the technological tools for storing and distributing appropriate knowledge. The major components of knowledge management systems are considered to be: best practices, communication enablers, and system road maps. The main purpose of these components is to provide users with the right information at the right time and place. Experience showed that successful knowledge management system developers are those that enable collaboration between all these tools (Maier 2002).

Knowledge management systems might also be viewed as important organisational assets that provide core competencies for the organisation. In particular, highly knowledge-intensive organisations might view the systematic handling of knowledge in general and especially their information and communication technologies systems supporting knowledge management as their core competence and fear that they might lose a strategic advantage if they implement a standard software solution available on the market (Thierauf 1999).

6 From the information system toward the knowledge management system

The task of implementing a successful knowledge management system may seem insurmountable. But in reality there are different views/approaches regarding the implementation of a knowledge management system. Some experts have stated that up to 90 percent of the infrastructure required for knowledge management is already in place. In most organ-

isations this refers to their existing structure of computer networks and servers. Hence, only a small shift in the total computer technology budget is required to change a knowledge management system (Lasker and Norton 1996). The success of an organisation is more dependent on its capability to create an effective environment for knowledge generation and application and on the knowledge and talent it can recruit, develop and retain in order to provide the innovation (Kim et al. 1999). Knowledge work processes drive a successful knowledge management system, not the technological issues. These systems help decision makers to make better decisions in terms of their work activities. The technology is incidental to this critical issue.

A redesign may be necessary for changing knowledge work processes:

- *The content of knowledge should be changed* by expanding or contracting what it encompasses in order to better meet desirable objectives.
- *The composition of work should be reordered* so that company personnel may change the focus of their jobs from information to knowledge.
- *A new networking technology that would lend itself to groupware should be employed.*

Thierauf (1999) also summarizes critical factors for determining the appropriate software useful for providing knowledge for decision makers and managing the software. For example:

- Is the software easy to use for developing knowledge?
- Does the software provide an in-depth analysis of patterns and trends?
- Does the software actually do what decision makers want here and now?
- Does the software allow decision makers to access and analyse a large amount of information in order to get at pertinent knowledge?
- Is the software generally a combination of packages designed for the organisation's size or will it be outgrown in a few years?
- Does the software provide flexibility in the development of pertinent knowledge to meet decision makers' needs?

Today, knowledge management systems often integrate a variety of off-the-shelf software products, such as groupware, document manage-

ment systems, e-mail, relational databases, and workflow, with knowledge extraction tools, knowledge management intranet search engines, and knowledge discovery or a data mining software. In addition, a knowledge management system can employ the OLAP software, a statistical analysis software to assist decision makers in getting the knowledge at hand. Depending on the nature and purpose of a knowledge management system, there can be still other software products and hardware needed to form a complete knowledge management system package to gather, organise, collaborate, refine, and distribute knowledge (Thierauf 1999). Most organisations that have actually implemented knowledge management system solutions have combined several tools and implemented additional functions on their own rather than simply buy specialised knowledge management system software on the market.

A classification of a knowledge management system can only be considered as preliminary due to the considerable dynamics of the knowledge management market. At this stage, the analysis of a knowledge management system is a great challenge. This is already visible in the difficulties of defining the term and continues in the trial to present a typical architecture of such systems or to give a comprehensive list of its functions. The same is true for a classification of a knowledge management system. The pragmatic perspective that knowledge management systems are just document management systems with some added functionality which seems to dominate the marker is unsatisfying. Information and communication technologies support for knowledge management is not restricted to the handling of documented knowledge (Maier 2002).

Information and communication technologies infrastructure needs strategy to define knowledge goals and subsequently implement organisational instruments, roles and processes, and an organisational culture supportive of knowledge sharing in order to create benefits for the organisation.

Knowledge management system vendors as well as organisations applying those systems have shift focus from the explicit side of knowledge management to a combination and integration of its implicit side.

7 SIMILARITIES AND DIFFERENCES BETWEEN INFORMATION SYSTEMS AND KNOWLEDGE MANAGEMENT SYSTEMS

During the analysis of information systems and knowledge management systems, similarities and differences of both areas were ascertained.

Overview of Similarities and Differences between Both Systems

Knowledge management systems or knowledge management suites are operated on the basis of an (organisation-wide) information and communication infrastructure, in most cases an Intranet platform of Lotus Notes environment, which facilitates information sharing among (virtual) teams within the organisation or between the teams and allies, suppliers and customers. Most organisations have installed a large number of application systems and information and communication technologies platforms that provide functionality to knowledge management. The basic functionality of such an information and communication technologies platform designed 'with knowledge management in mind' would comprise an integrated set of the following functions:

- *Communication:* as well as coordination and cooperation, e. g. e-mail, workflow management, newsgroup or list server.
- *Document management:* handling documents throughout their life cycle.
- *Access:* to various data sources, e. g. relational data bases, document bases, file servers or Web servers.
- *Search:* basic search functionality.
- *Visualisation.*

In a somewhat narrower sense, knowledge management systems provide a functionality that goes well beyond these basic functions. Nevertheless, there is no single hardware or software product or a combination of the two that can provide a comprehensive approach to knowledge work. Building a corporate-wide knowledge management infrastructure requires the integration of many different technologies. It is necessary not only to implement an integrated hardware or a software technology but also to integrate a company's personnel and their related business processes with this knowledge management technology. If company personnel are not working in a collaborative environment or if no procedures and processes are in place to share the *knowledge,* no amount of knowledge management system technology can change that (Thierauf 1999). In other words, a knowledge management system requires a systemic knowledge management initiative in order to be used effectively and efficiently. This includes a knowledge management system strategy and the development of knowledge management system goals, an appropriate organisational design describing roles responsible for knowledge-related tasks and processes that use the knowledge management system, a

supportive organisational culture and a corresponding knowledge management system supervision that evaluates whether the goals of using these systems have been achieved (Maier 2002). The main differences between a knowledge management system and more traditional information and communication technologies systems, such as document management systems, Intranet solutions or Groupware can be characterised as follows (Maier 2002):

- Contextualised combination and integration of functionality;
- Organisation-wide focus;
- Integration of intelligent functions;
- Matching with knowledge management initiatives;
- Dynamics of organisational learning.

Analysis of Similarities and Differences between Information Systems and Knowledge Management Systems

The aim of this section is to provide a detailed analysis of both an information and a knowledge management system.

As was described in previous sections, information systems and knowledge management systems have many common features. However, the differences between both systems cannot be declared only by their name or goals. We applied the Enterprise Knowledge Development (EKD) methodology to analyse differences between knowledge management systems and information systems.

Fig. 1 describes the concepts that are essential for information and knowledge management systems. Boxes that are in white colour denote concepts that are related to both systems, boxes tint in light grey represent concepts unique for knowledge management systems, and dark grey boxes refer only to information systems.

Fig. 1 shows that most of the concepts are common to both systems. Although some information systems are implemented and maintained to support only one business process, there are knowledge management systems that support many integrated business processes as well as specific knowledge related processes. Besides that, the concept of knowledge is clearly defined in knowledge management systems. It denotes that in the implementation process of a knowledge management system the content to be managed is very important. Moreover, an efficient knowledge management system requires knowledge management initiatives, namely, leadership, measurement, and organisation culture.

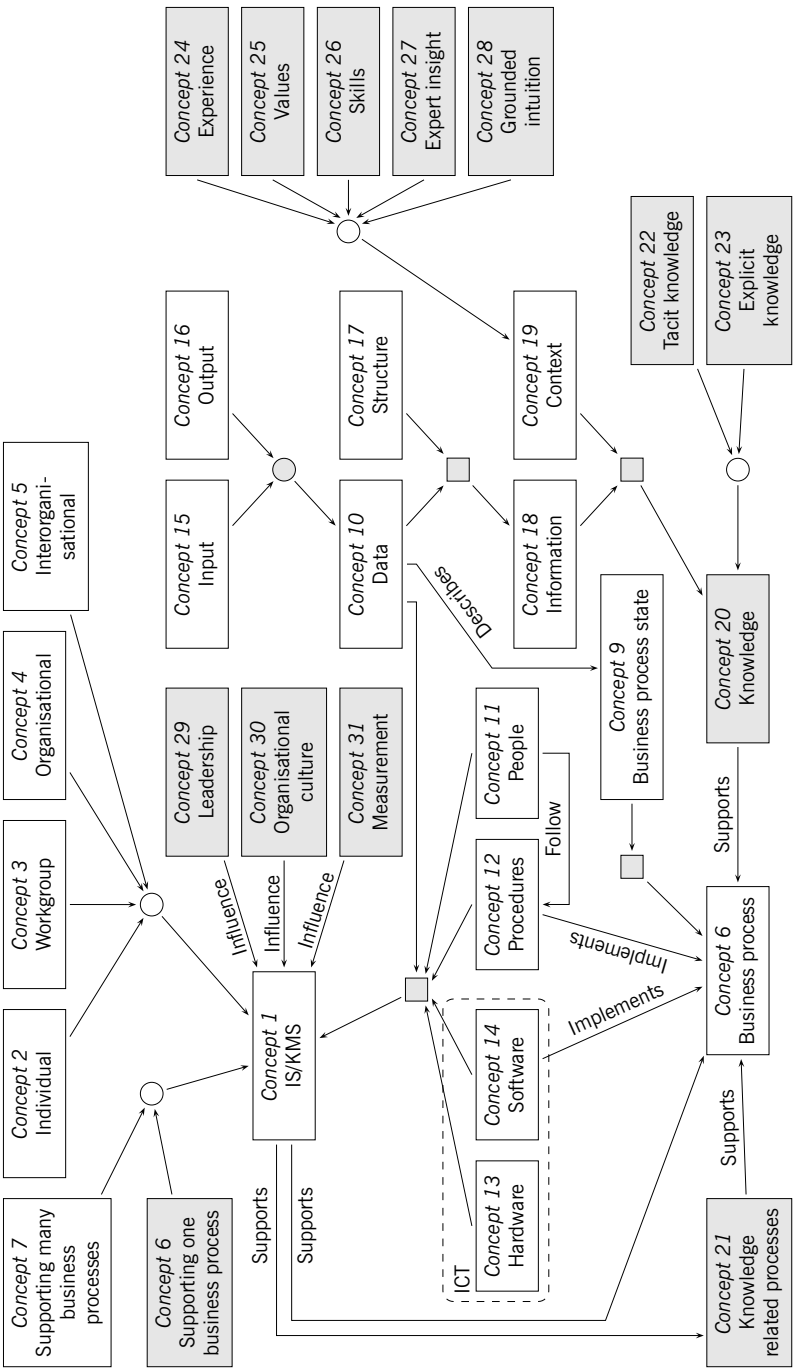

FIGURE 1 A concept model of the information system and the knowledge management system

Fig. 2 describes the business processes of both systems. Boxes with rounded corners that are shadowed denote external processes that are performed by users. Other boxes are system processes accomplished by a computerised system, whether it is an information system or a knowledge management system.

Specific processes of knowledge management are only concerned with knowledge (creation, identification, sharing, formalisation, collection, organisation, transfer, and, finally, application of knowledge). However, it is essential to stress that internal processes of a knowledge management system (processes 4, 5 and 6) use general information system processes (1, 2 and 3). Thereby, during the performance of the knowledge management system's processes, explicit knowledge becomes some kind of data or information that can be stored and processed by the information system. That confirms that knowledge management system is always supported by an information system.

The analysis of both systems enabled the identification of their goals, opportunities (or benefits) and problems. One of the main goals of both systems is to support one business process, i. e. decision making. In this process the information system provides just a better information, while knowledge management system provides an intelligent decision making based on best practices, organisational knowledge and experience that nowadays are crucial for organisations that are confronted with an increased environmental complexity and dynamics.

8 Conclusions and Further Research

The paper deals with issues concerning information systems and knowledge management systems. The main conclusions derived from the analysis of these two systems are the following:

- While in practice, the terms *data, information and knowledge* are often used interchangeably, they are essentially different and play different roles in both information and knowledge management systems.
  Information systems provide several benefits to the organisation such as a better information, which is a basis for a good decision making, improved service, and increased productivity.
- Typically, the *organisation's knowledge* already exists within the organisation, but is handled by a number of incompatible information and communication technology systems.

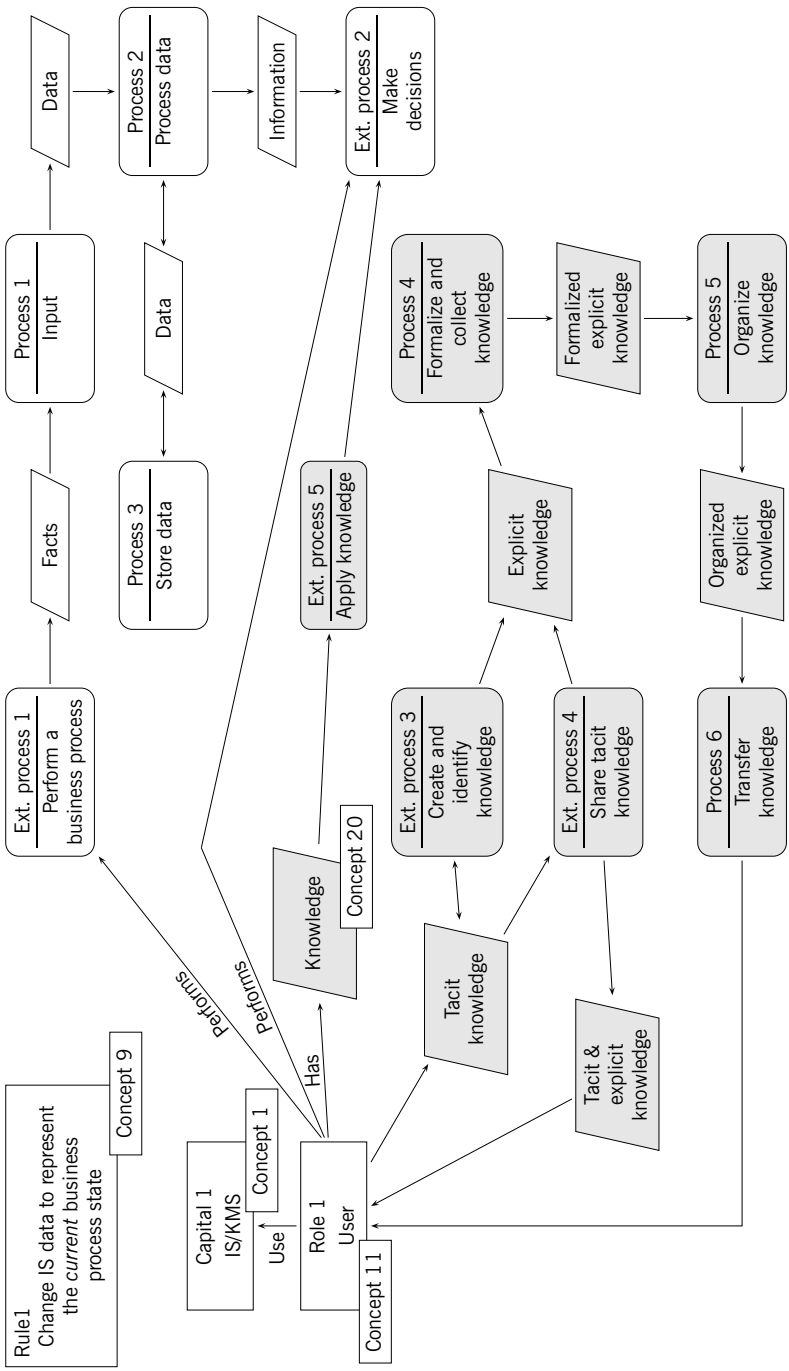

FIGURE 2 A business process model of the information system and the knowledge management system

- *Knowledge management:*
    1. is a systematic and articulate approach to managing knowledge related processes;
    2. represents an opportunity to derive additional benefits from the organisation's existing investment in computers, databases and networks by integrating them to support knowledge management;
    3. has been implemented by companies which give special consideration to organisational knowledge;
    4. has to handle and improve complex relationships and networks rather than individual knowledge elements or just one location.

- *Knowledge management systems:*
    1. have been a strong metaphor or vision for the development of a new breed of information and communication technology systems;
    2. are operated on the basis of an (organisation-wide) information and communication infrastructure;
    3. organise and make available important know-how wherever and whenever it is needed;
    4. require a systemic knowledge management initiative in order to be used effectively and efficiently.
- *Development of the knowledge management system* is a complex undertaking:
    1. during the process of implementing a knowledge management system great importance should be given to the content to be managed;
    2. *technologies* by themselves do not constitute a knowledge management programme, they rather facilitate one, and they are very important and useful as enablers for the implementation of knowledge management approaches;
    3. knowledge work processes drive a successful knowledge management system and a redesign may be necessary for changing knowledge work processes.
- Due to the considerable dynamics of the market for knowledge management there are difficulties in presenting a typical architecture of knowledge management systems or providing a comprehensive list of functions.

- *The border between information systems and knowledge management systems* is diffused and depends on many factors, namely, an organisation's strategy and goals concerning business and knowledge processes, culture, initiatives, information and communication technologies etc.

Future research is aimed at refining the architecture of knowledge management systems and organisational information systems and providing a deeper analysis of the dependency between these two systems.

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